

Before the
Federal Communications Commission
Washington, D.C. 20554

In the Matter of)	
)	
Review of the Spectrum Sharing Plan Among)	
Non-Geostationary Satellite Orbit Mobile Satellite)	IB Docket No. <u>02-364</u>
Service Systems in the 1.6/2.4 GHz Bands)	
)	
Amendment of Part 2 of the Commission's Rules)	
to Allocate Spectrum Below 3 GHz for Mobile)	ET Docket No. 00-258
and Fixed Services to Support the Introduction of)	
New Advanced Wireless Services, including)	
Third Generation Wireless Systems)	

**REPORT AND ORDER, FOURTH REPORT AND ORDER
AND FURTHER NOTICE OF PROPOSED RULEMAKING**

Adopted: June 10, 2004

Released: July 16, 2004

Comment Date: 30 days after Federal Register publication

Reply Comment Date: 45 days after Federal Register publication

By the Commission:

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I. INTRODUCTION

1. In this Order, we adopt a spectrum sharing plan in the 1610-1626.5 MHz band (1.6 GHz or L-band) and the 2483.5-2500 MHz band (2.4 GHz or S-band) (collectively referred to as the Big LEO bands or Big LEO spectrum).¹ Under this spectrum sharing plan, code division multiple access (CDMA) mobile-satellite service (MSS) operators will share certain portions of Big LEO spectrum with time division multiple access (TDMA) MSS operators in the L-band, and fixed and mobile terrestrial wireless operators in the S-band. In particular, we: (1) allow TDMA MSS operators to share the 1618.25-1621.35 MHz band with CDMA MSS operators; and (2) allocate the 2495-2500 MHz band for fixed and mobile except aeronautical mobile services on a primary basis, which will share this band with CDMA MSS operators providing MSS service on an unprotected basis.²

2. In addition, we find that the hearing requirements of sections 316 and 312 of the Communications Act of 1934, as amended (Act),³ do not apply to this proceeding. We also move ancillary terrestrial component (ATC) operations from 2492.5-2498 MHz to 2487.5-2493 MHz in the S-band due to fixed and mobile terrestrial wireless operators having access to the upper portion of that band. We decline, however, to increase the amount of Big LEO spectrum available for ATC operations. In addition, we find that the Big LEO spectrum sharing band plan complies with relevant International

¹ Low Earth Orbit satellites (LEOs) are classified as Big LEOs or Little LEOs. Big LEOs provide voice and data communications above 1 GHz, while Little LEOs provide data communications below 1 GHz.

² The decision to allocate the 2495-2500 MHz band for fixed and mobile except aeronautical mobile services constitutes the Fourth Report and Order in ET Docket No. 00-258.

³ 47 U.S.C. §§ 316(a)(1), 312(c).

Telecommunication Union (ITU) radio regulations. Finally, we issue a Further Notice of Proposed Rulemaking to explore whether CDMA and TDMA MSS operators feasibly could share additional spectrum in the L-band. We adopt this Order concurrently with another order in which we: (1) incorporate the spectrum at 2495-2500 MHz into the 2500-2690 MHz band currently used for multipoint distribution service (MDS) and instructional television fixed service (ITFS) operators; (2) restructure the services occupying 2495-2690 MHz into a new Broadband Radio Service (BRS)/ Educational Broadband Service (EBS) band plan; (3) provide spectrum to accommodate MDS operators currently located at 2150-2162 MHz within the new 2495-2690 MHz band; and (4) adopt the licensing and service rules for those operators in that band.⁴

3. In our decision today, we make changes to the Big LEO band plan in an effort to promote spectral efficiency while ensuring that operators in the Big LEO bands can provide service without causing or experiencing harmful interference.⁵ When the Commission initially adopted the Big LEO band plan, it licensed five companies to provide MSS in the Big LEO bands.⁶ Two Big LEO systems were implemented and are now providing MSS – one TDMA system and one CDMA system. In this proceeding, we consider how this development impacts usage of Big LEO spectrum and, as a result, make changes to the existing band sharing plan. We believe that the new band plan promotes more efficient use of the spectrum than the existing band plan by requiring MSS providers to share certain portions of the spectrum in the L-band, and by allowing non-MSS operators to share a portion of spectrum in the S-band.

II. BACKGROUND

A. Initial License Proceedings

4. In 1990, the Ellipsat Corporation (Ellipsat) and Motorola Satellite Communications, Inc. (Motorola) filed license applications for authority to construct and operate satellite systems to provide MSS, i.e., satellite communication service for users equipped with earth station terminals that can be operated while in motion. Ellipsat proposed to operate with CDMA⁷ and requested assignment of 1610-1626.5 MHz for uplink transmission from mobile transceivers to satellites and 2483.5-2500 MHz for downlink transmission from the satellites to the transceivers.⁸ Motorola, which referred to its proposed

⁴ See generally *Amendment of Parts 1, 21, 73, 74 and 101 of the Commission's Rules to Facilitate the Provision of Fixed and Mobile Broadband Access, Educational and Other Advanced Services in the 2150-2162 and 2500-2690 MHz Bands*, WT Docket No. 03-66, Report and Order and Further Notice of Proposed Rulemaking, FCC 04-135 (adopted June 10, 2004) (*MDS/ITFS Order*).

⁵ See generally *Spectrum Policy Task Force Report*, ET Docket No. 02-135, November 2002. This document is available at http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-228542A1.doc.

⁶ See *infra* Section II.

⁷ CDMA is a digital transmission technique that involves modulating the signal by a code that is independent of the information data and spreading the signal over a wide bandwidth. The signal is reconstituted in receivers through application of a synchronized de-correlation code. The spreading of the signal and the use of coded modulation allows several CDMA systems to operate simultaneously in the same frequencies without mutual interference.

⁸ Radio communication channels between satellites and service subscribers' terminals are commonly referred to as "service links," a term frequently employed in this Order. We also use the more-specific terms "service uplinks" and "service downlinks" to denote service-link transmission from mobile terminals to satellites or *vice versa*. See also *infra* note 11.

system by the trade name "Iridium," proposed to operate with TDMA⁹ and use the 1610-1626.5 MHz band for service-link transmission in both directions (*i.e.*, bi-directional TDMA).

5. Ellipsat and Motorola proposed to construct non-geostationary-satellite-orbit (NGSO) MSS systems with global coverage. Their proposed use of NGSO satellites would orbit at much lower altitudes than geostationary-satellite-orbit (GSO) satellites, substantially reducing uplink power requirements, which made feasible the use of handheld transceivers. Hence, Ellipsat and Motorola proposed to provide a wide variety of MSS services to users equipped with handheld earth station transceivers, including two-way voice communication with interconnection to the public switched telephone network.

6. The Commission placed the Ellipsat and Motorola MSS applications on public notice and established a cut-off date for filing applications to be considered concurrently.¹⁰ Four additional applications were filed before the cut-off date, three of which proposed NGSO MSS systems that, like Ellipsat's, would operate with CDMA and use 1610-1626.5 MHz for service uplinks and 2483.5-2500 MHz for service downlinks.¹¹ Among the subsequent NGSO applicants was Loral Qualcomm Partnership (LQL), which called its proposed system "Globalstar." In sum, five NGSO applications were filed before the cut-off date – four proposing CDMA operation with 1610-1626.5 MHz service uplinks and 2483.5-2500 MHz service downlinks and Motorola's Iridium application, proposing TDMA operation with bi-directional service-link transmission in the 1610-1626.5 MHz band.

7. In addition to the five applications proposing NGSO systems, one other relevant application was filed before the cut-off date by American Mobile Satellite Corporation (AMSC).¹² AMSC requested modification of its existing GSO-MSS license to include authority for operation in the 1616.5-1626.5 MHz band, using either CDMA or TDMA.

8. At the time these applications were filed, neither the 1610-1626.5 MHz band nor the 2483.5-2500 MHz band was allocated for MSS. In response to proposals from the U.S. delegation, however, the 1992 World Administrative Radio Conference (WRC-92) of the ITU amended the international allocation table to add co-primary allocations for MSS uplink transmission in the 1610-1626.5 MHz band and MSS downlink transmission in the 2483.5-2500 MHz band and a secondary allocation for MSS

⁹ TDMA is a technique for using the same frequency band for transmission in alternating time slots in the same band. Both Motorola and Ellipsat also proposed to use frequency division multiple access, *i.e.*, to divide assigned frequency bands into multiple channels with different center frequencies.

¹⁰ Public Notice, Report No. DS-1068, 6 FCC Rcd 2083 (1991).

¹¹ The radio communication links in both directions between MSS satellites and end-users' transceivers are "service links." See *supra* note 8. A counterpart term, "feeder links," refers to the links between the satellites and fixed earth stations, called "gateways," where caller ID and routing are performed.

¹² The Commission had previously issued only one MSS license. That license, granted in 1989 to AMSC, authorized construction of a GSO system with 50-state coverage and assigned the 1545-1559 MHz and 1646.5-1660.5 MHz bands for service links. See *Amendment of Parts 2, 22 and 25 of the Commission's Rules to Allocate Spectrum for and to Establish Other Rules and Policies Pertaining to the Use of Radio Frequencies in a Land Mobile Satellite Service for the Provision of Various Common Carrier Services*, GEN Docket No. 84-1234, Memorandum Opinion and Order, FCC 89-183, 4 FCC Rcd 6041 (1989).

downlinks in the 1613.8-1626.5 MHz band.¹³ The Commission later adopted conforming domestic allocations.¹⁴

9. In December 1992, the Commission established a negotiated-rulemaking committee (NR Committee) with representatives from all six MSS applicants, among others, to provide advice and recommendations regarding MSS operation in the Big LEO bands.¹⁵ The NR Committee could not agree to a single proposal and, as a result, submitted two separate reports on intra-service spectrum issues – one provided by Motorola and another endorsed by the other five MSS applicants (majority coalition).

10. The majority coalition advocated a band plan that would allow all qualified applicants to share the entire 1610-1626.5 MHz band for CDMA uplinks and the entire 2483.5-2500 MHz band for CDMA downlinks and allow TDMA uplink transmission in the top 2.75 megahertz of the 1610-1626.5 MHz band and TDMA downlink transmission in the top 2.75 megahertz of the 2483.5-2500 MHz band.¹⁶ The majority coalition urged the Commission to prohibit downlink transmission in the 1610-1626.5 MHz band, arguing that such operation would be incompatible with their proposed use of the band for service uplinks. The majority coalition maintained that excluding downlink operations would allow the 1.6 GHz band to accommodate service uplinks for as many as six MSS systems, including a GSO system.

11. Motorola advocated a band-splitting plan that would allot 1610-1618.25 MHz for CDMA uplinks and 1618.25-1626.5 MHz for bi-directional TDMA operation.¹⁷ Although Motorola agreed that use of a frequency band for TDMA service-link transmission in both directions would effectively preclude use of the same band for CDMA service uplinks,¹⁸ Motorola maintained that authority for bi-

¹³ *Final Acts of the 1992 World Administrative Radio Conference*, Malaga-Torremolinos (1992). A station lawfully using a frequency band for service of a type for which the band is allocated on a primary basis is entitled to protection against interference from stations that use the band for secondary-status services. Stations operating in a secondary service cannot claim interference protection from stations lawfully operating in a primary service. See 47 C.F.R. §§ 2.104(d) and 2.105(c) (2003).

¹⁴ *Amendment of Section 2.106 of the Commission's Rules to Allocate the 1610-1626.5 MHz and the 2483.5-2500 MHz Bands for Use by the Mobile-Satellite Service, Including Non-Geostationary Satellites*, Report and Order, FCC 93-547, 9 FCC Rcd 536 (1994). Prior to WRC-92, Motorola had urged the Commission to recommend adoption of a *primary* international allocation for MSS downlinks in the 1613.8-1626.5 MHz band, but the Commission declined to do so because of the concern about possible interference with radionavigation services. See *Inquiry Relating to Preparation for the International Telecommunication Union World Administrative Radio Conference for Dealing with Frequency Allocations in Certain Parts of the Spectrum*, Report, GEN Docket No. 89-554, Report, FCC 91-188, 6 FCC Rcd 3900, 3907, ¶¶ 51, 57 (1991).

¹⁵ *MSS Above 1 GHz Negotiated Rulemaking Committee*, CC Docket No. 92-166, Public Notice, DA 92-1691, Report No. DS-1265, 7 FCC Rcd 8614 (1992). The Commission chartered the NR Committee pursuant to the Negotiated Rulemaking Act of 1990, 5 U.S.C. §§ 581 *et seq.*

¹⁶ *Report of MSS Above 1 GHz Negotiated Rulemaking Committee*, (April 6, 1993), Annex 1, Attach. 1 at 5-33. The majority coalition proposed use of polarization discrimination to prevent interference between CDMA and TDMA operations. Under the majority coalition's plan, TDMA transmission would be righthand-circular-polarized, and CDMA transmission in frequencies used for TDMA operation would be lefthand-circular-polarized.

¹⁷ *Id.* at § 2.1. Motorola recommended, however, that if all operational systems are of the same kind (*e.g.*, either all CDMA or all TDMA bi-directional), they should all share a single, common uplink band.

¹⁸ *Id.*, Annex 1, Attach. 2 at 8 and 99.

directional operation in a portion of the 1610-1626.5 MHz band was indispensable for implementation of the Iridium system because the 2483.5-2500 MHz band was unsuitable for Iridium service downlinks.¹⁹ Further, Motorola argued that such a TDMA system should be assigned frequencies in the *upper* half of the available L-band spectrum because, among other things, the international allocation table barred downlink operation below 1613.8 MHz.²⁰

12. Subsequently, the NGSO-CDMA applicants abandoned the full-band-sharing proposal and, in concert with Motorola, advocated adoption of rules that would preclude assignment of any of the Big LEO spectrum for use by GSO systems and would reserve a separate segment of the 1610-1626.5 MHz band for bi-directional TDMA transmission.²¹

1. Big LEO NPRM

13. In 1994, the Commission proposed adoption of licensing policies in the *Big LEO NPRM*.²² The Commission initially proposed to limit license eligibility to applicants proposing NGSO systems.²³ In addition, because there was no record basis for finding that CDMA was inherently superior to TDMA, or *vice versa*,²⁴ and because the applicants all agreed that CDMA systems could share compatibly spectrum with each other but could not operate compatibly in spectrum used for TDMA downlinks, the Commission proposed to divide the 1610-1626.5 MHz band into two separate segments, one for CDMA uplink transmission and the other for bi-directional TDMA transmission. Specifically, the Commission proposed to designate 1610-1621.35 MHz for shared use by up to four systems for CDMA uplink transmission and 1621.35-1626.5 MHz for bi-directional transmission by one TDMA system.²⁵ The Commission also proposed to assign 11.35 megahertz of downlink spectrum in the S-band for shared use

¹⁹ Specifically, Motorola contended that the 2483.5-2500 MHz band was unsuitable for Iridium downlinks because pertinent ITU limits on power flux density (PFD) precluded downlink operation in that band with link margins that the Iridium system would need to achieve desired service quality for two reasons. First, Motorola argued that worldwide coordination of Iridium downlinks in that band would be impossible due to the large number of terrestrial radio stations operating therein. In addition, Industrial, Scientific, and Medical transmission in that band would interfere with same-frequency Iridium downlink reception in metropolitan areas. *Id.* at 122-123.

²⁰ *Id.* at 102. Motorola also argued that it needed to operate its system in the upper portion of the 1.6 GHz band because downlink transmission in frequencies below 1616 MHz would interfere with radio astronomy observation; and regulatory limits on transmission power in the 1610-1616 MHz band were too restrictive for TDMA systems. *Id.* Motorola had accordingly amended the Iridium application in August 1992 to request assignment of 1616-1626.5 MHz instead of 1610-1626.5 MHz. File No. 43-AMEND-DSS-92.

²¹ See generally Jointly Filed Comments of Motorola and LQL (Oct. 7, 1993) and Joint Spectrum Sharing Proposal of Constellation, Ellipsat, and TRW (Oct. 8, 1993) (filed in CC Docket No. 92-166).

²² *Amendment of the Commission's Rules to Establish Rules and Policies Pertaining to a Mobile Satellite Service in the 1610-1626.5/2483.5-2500 MHz Frequency Bands*, CC Docket No. 92-166, Notice of Proposed Rulemaking, FCC 94-11, 9 FCC Rcd 1094 (1994) (*Big LEO NPRM*).

²³ *Id.* at 1105-1106, ¶¶ 21-22.

²⁴ See *Amendment of the Commission's Rules to Establish Rules and Policies Pertaining to a Mobile Satellite Service in the 1610-1626.5/2483.5-2500 MHz Frequency Bands*, CC Docket No. 92-166, Report and Order, FCC 94-261, 9 FCC Rcd 5936, n.52 (1994) (*Big LEO Order*), modified on recon., FCC 96-54, 11 FCC Rcd 12861 (1996).

²⁵ *Big LEO NPRM*, 9 FCC Rcd at 1110, 1111, ¶¶ 31-32.

by CDMA systems.²⁶ In addition, the Commission proposed to insert a condition in each CDMA-system license that would reduce the assigned uplink bandwidth from 11.35 megahertz to 8.25 megahertz "[i]n the unlikely event that [no other] CDMA system is implemented."²⁷

14. The Commission proposed this band plan as a compromise that would afford precisely as many NGSO-CDMA and NGSO-TDMA license slots, respectively, as the number of applicants respectively proposing NGSO-CDMA and NGSO-TDMA operation, with the express hope that adoption of the plan would facilitate resolution of mutual exclusivity.²⁸

15. Motorola and three of the four applicants proposing NGSO-CDMA systems subsequently entered into a settlement agreement, pursuant to which they jointly urged the Commission to adopt the plan outlined in the *Big LEO NPRM* for assignment of spectrum in the 1610-1626.5 MHz band. In addition, they requested that the Commission: (1) assign the 2483.5-2500 MHz downlink band for shared use by CDMA systems; (2) adjust the band plan to equitably apportion the burden of any loss of spectrum use above 1610 MHz due to requirements for protection of the Russian Global Navigation Satellite System's (GLONASS') radionavigation signals on carrier frequencies above 1605.375 MHz; and (3) in the event a single TDMA system and only one CDMA system were to become operational, consider reassignment of some or all of the 1618.25-1621.35 MHz segment to the TDMA licensee based on a showing of need.²⁹ LQL, the Globalstar proponent, did not sign the settlement agreement but filed a statement in which it agreed that 1610-1621.35 MHz should be reserved for sharing by up to four CDMA systems and 1621.35-1626.5 MHz for bi-directional transmission by a single TDMA system, as proposed in the *Big LEO NPRM*, and that 2483.5-2500 MHz should be assigned for CDMA downlink transmission.³⁰

2. Big LEO Order

16. In October 1994, the Commission issued the *Big LEO Order* establishing licensing and service rules for MSS operation in the 1610-1626.5 MHz and 2483.5-2500 MHz bands.³¹ As proposed in the *Big LEO NPRM*, and as recommended by LQL and the parties to the settlement agreement, the Commission: (1) restricted eligibility to applicants proposing NGSO systems (absent proof that a GSO system could operate compatibly with NGSO systems in the spectrum bands in question); (2) designated

²⁶ *Id.* at 1113-1114, ¶ 37.

²⁷ *Id.* at 1112, ¶ 33.

²⁸ *Id.* at 1111, ¶ 32. The Commission inferred that 11.5 MHz would suffice to accommodate four NGSO-CDMA systems, simply because four applicants were proposing such systems and three of them jointly advocated reservation of 11.5 MHz (at 1610-1621.5 MHz) for NGSO-CDMA uplinks. *Id.* at 1110-1111, ¶ 31. The Commission noted, moreover, that Motorola had indicated in a recent pleading that 5.25 MHz would suffice for bi-directional service-link transmission for a single TDMA system. *Id.*

²⁹ See attachment to Joint Proposal and Supplemental Comments (filed Sept. 9, 1994). The parties to the settlement agreement promised to amend their applications to conform to the proposed band plan and withdraw previously-filed petitions to deny in the event the Commission adopted their joint recommendations. *Id.* at 12.

³⁰ Letter from Philip L. Verveer, Counsel for LQL, to William F. Caton, Acting Secretary, FCC, CC Docket No. 92-166 (dated Sept. 13, 1994).

³¹ See *supra* note 24.

1610-1621.35 MHz for assignment for service uplink transmission by up to four CDMA systems; and (3) designated 1621.35-1626.5 MHz for assignment to a single TDMA system for bi-directional transmission.³² The Commission adopted the assignment plan for the 1610-1626.5 MHz band based on the support of the five applicants proposing NGSO systems.³³

17. The Commission also concluded in the *Big LEO Order* that it should assign the entire 16.5 megahertz of allocated MSS downlink spectrum at 2483.5-2500 MHz to CDMA system licensees for shared use, rather than merely assigning them an 11.35 megahertz portion of that band to match the bandwidth of their service-uplink band. The Commission based its conclusion on the CDMA applicants' contentions that they needed additional bandwidth in the allocated downlink band because the regulatory limits on power flux density (PFD)³⁴ affected traffic-handling capacity and because it was necessary to operate across the entire band to achieve maximum capacity at minimum cost. The Commission stated that assignment of the entire allocated downlink band would afford CDMA licensees flexibility for coordination with each other and with other users.³⁵

18. In the *Big LEO Order*, the Commission did not adopt its proposal in the *Big LEO NPRM* to reduce a CDMA licensee's uplink assignment by 3.1 megahertz from 1610-1621.35 MHz to 1610-1618.25 MHz if no other CDMA system were implemented.³⁶ The Commission acknowledged commenters' concerns that the lower half of the L-band might provide significantly less capacity than the upper half due to the constraints placed on MSS operators to protect radio astronomy service (RAS)³⁷ in the 1610.6-1613.8 MHz band and GLONASS radionavigation service in the 1598-1610 MHz band.³⁸ The Commission also stated that it did not know the impact of foreign-licensed satellite systems on U.S.-licensed systems across the entire band.³⁹ Therefore, the Commission stated that it would refrain from deciding whether any such adjustment was warranted unless and until: (1) no CDMA system was

³² *Big LEO Order*, 9 FCC Rcd at 5945, 5955, ¶¶ 15, 45.

³³ *Id.* at 5955, ¶ 44.

³⁴ PFD is a measure of the power, incident on the Earth's surface, from a satellite or constellation of satellites. PFD is a limit commonly placed on satellite systems to ensure that they can share with the terrestrial fixed and mobile services. PFD is also a major constraint on the amount of information that may be transmitted from a satellite to its earth stations.

³⁵ *Big LEO Order*, 9 FCC Rcd at 5956, ¶¶ 47, 48.

³⁶ *Id.* at 5959-5960, ¶¶ 55-56.

³⁷ RAS operations obtain information about the universe through radio reception. *Id.* at 5976, ¶ 100. RAS operates in the 1610.6-1613.8 MHz frequency band on a co-primary basis, which entitles RAS to protection against harmful interference. *Id.*

³⁸ See, e.g., *Amendment of Parts 2 and 25 to Implement the Global Mobile Personal Communications by Satellite (GMPCS) Memorandum of Understanding and Arrangements*, IB Docket No. 99-67, Report and Order and Further Notice of Proposed Rulemaking, FCC 02-134, 17 FCC Rcd 8903, 8907, ¶ 5 (2002). The International Civil Aviation Organization selected two satellite radionavigation systems for use as components of Global Navigation Satellite System (GNSS) for aeronautical applications: the NAVSTAR Global Positioning System (GPS) and GLONASS. *Id.* at 8906, ¶ 3. The Russian Federation plans to move GLONASS to below 1606 MHz by 2005. *Id.* at 8907, ¶ 5.

³⁹ *Big LEO Order*, 9 FCC Rcd at 5960, ¶ 55.

licensed; (2) only one CDMA system was licensed; or (3) two or more CDMA systems were licensed, except all but one of the CDMA-system licenses were later declared null and void for failure to meet implementation-milestone deadlines.⁴⁰ The Commission said that if confronted with one of these circumstances, it would institute a rulemaking proceeding with respect to the 3.1 megahertz between 1618.25 and 1621.35 MHz.⁴¹

B. MSS Licenses Granted in the Big LEO Bands

19. Pursuant to the rules and policies adopted in the *Big LEO Order*, the Commission's International Bureau⁴² granted licenses for four CDMA NGSO MSS systems, authorizing use of the 1610-1621.35 MHz band for service uplinks and 2483.5-2500 MHz for service downlinks. The recipients of the CDMA licenses were LQL, the proponent of the Globalstar system; TRW, Inc., which proposed to construct and operate a system called "Odyssey;" Mobile Communications Holdings, Inc. (MCHI), the proponent of the Ellipso system; and Constellation Communications, Inc., which proposed to construct and operate a system called "Aries."⁴³ The International Bureau also granted Motorola's license application for the Iridium system, authorizing bi-directional TDMA operation in the 1621.35-1626.5 MHz band.⁴⁴ The only participant in the processing round that did not receive a license was AMSC, which had requested add-on frequencies for its existing GSO system. The Commission eventually dismissed its application for failure to file financial information.⁴⁵

⁴⁰ *Id.* at 5959, 5960, ¶ 55 and n.65.

⁴¹ *Id.* at 5960, 5961, ¶¶ 55, 57.

⁴² We note that the International Bureau together with the Office of Engineering and Technology granted two of the licenses. *See infra* note 43.

⁴³ *See Loral/Qualcomm Partnership, L.P.*, Order and Authorization, DA 95-128, 10 FCC Rcd 2333 (Int'l Bur. 1995), erratum, 10 FCC Rcd 3926 (1995) (*Globalstar License Order*), recon. denied, 11 FCC Rcd 18502 (1996), modification granted, 11 FCC Rcd 16410 (1996) (assigning feeder-link frequencies); *TRW, Inc.*, Order and Authorization, DA 95-130, 10 FCC Rcd 2263 (Int'l Bur. 1995), erratum, 10 FCC Rcd 3924 (1995), recon. denied, 11 FCC Rcd 18502 (1996), modification granted, 11 FCC Rcd 20419 (1996) (assigning feeder-link frequencies); *Mobile Communications Holdings, Inc.*, Order and Authorization, DA 97-1367, 12 FCC Rcd 9663 (Int'l Bur. and OET 1997); and *Constellation Communications, Inc.*, Order and Authorization, 12 FCC Rcd 9651 (Int'l Bur. and OET 1997); *see also AirTouch Satellite Services US, Inc.*, Order and Authorization, DA 99-2010, 14 FCC Rcd 17328 (Int'l Bur. 1999) (blanket license for GLOBALSTAR transceivers), and Radio Station Authorization granted Feb. 27, 1998, Call Sign E970199, File No. SES-LIC-19970310-00343 (license for GLOBALSTAR control/gateway station in Texas).

⁴⁴ *Motorola Satellite Communications, Inc.*, Order and Authorization, DA 95-131, 10 FCC Rcd 2268 (Int'l Bur. 1995) (*Iridium License Order*), erratum, 10 FCC Rcd 3925 (1995), recon. denied, 11 FCC Rcd 18502 (1996), modification granted, 11 FCC Rcd 13952 (1996) (assigning feeder-link frequencies), further modification granted, 14 FCC Rcd 9829 (1999) (authorizing additional in-orbit spares); *see also U.S. Leo Services, Inc.*, Order and Authorization, DA 96-1790, 11 FCC Rcd 13962 (Int'l Bur. 1996) (license for Iridium control/gateway earth station in Arizona); *U.S. Leo Services, Inc.*, Order and Authorization, DA 96-1962, 11 FCC Rcd 20474 (Int'l Bur. 1996) (blanket license for Iridium transceivers); and *Motorola Satellite Communications, Inc.*, Order and Authorization, DA 97-229, 12 FCC Rcd 1456 (Int'l Bur. 1997) (licenses for Iridium control stations in Hawaii).

⁴⁵ Letter from Donald H. Gips, Chief, International Bureau, FCC, to Lon C. Levin, Bruce D. Jacobs, and Glenn S. Richards, Counsel for AMSC (dated Jan. 31, 1997).

C. The Existing Big LEO Systems

20. The systems authorized by the licenses issued to TRW, MCH, and Constellation never were implemented, and those licenses are no longer in force. TRW returned the Odyssey license to the Commission in 1998.⁴⁶ In affirming previous determinations by the International Bureau, the Commission ruled that the Ellipso and Aries licenses were null and void because MCH and Constellation had failed to meet deadlines for commencement of satellite construction and had not shown good cause for an extension or waiver.⁴⁷

21. Motorola, with its Iridium TDMA system, and LQL, with its Globalstar CDMA system, successfully implemented their MSS systems in the Big LEO bands pursuant to valid satellite and earth station licenses. Both systems were constructed and placed into operation within the time periods specified in the satellite licenses. The Iridium system commenced commercial operation in November 1998, with a constellation of sixty-six functional NGSO satellites and twenty in-orbit spares. The Globalstar system commenced commercial operation in North America in March 2000 with a full constellation of forty-eight functional NGSO satellites, four in-orbit spares, and seven spares in ground storage.

22. In August 1999, the Motorola subsidiary with principal financial responsibility for Iridium operation filed for protection from creditors under Chapter 11 of the Bankruptcy Code. The Iridium system ceased commercial operation in the spring of 2000, and Motorola prepared to remove the satellites from orbit, but a bankruptcy sale of the Iridium assets shortly before the scheduled starting date for de-orbiting preserved the system from imminent destruction.⁴⁸ The purchaser was Iridium,⁴⁹ a newly-formed company that had entered into a contract with the Department of Defense (DOD) for provision of service for up to 20,000 users.⁵⁰ Acting as resellers, Iridium and affiliates began providing Iridium service to the DOD in December 2000 and to other subscribers in March 2001, while awaiting disposition of applications for assignment of the Iridium authorizations from the incumbent license-holders. The International Bureau granted the assignment applications early in the following year,⁵¹ and Iridium has continued operations since then.

⁴⁶ See Public Notice, Report No. SPB-114 (Jan. 15, 1998).

⁴⁷ *Mobile Communications Holdings, Inc.*, Memorandum Opinion and Order, FCC 03-122, 18 FCC Rcd 11650 (2003); *Constellation Communications Holdings, Inc.*, Memorandum Opinion and Order, FCC 03-217, 18 FCC Rcd 18822 (2003). Neither MCH nor Constellation filed for reconsideration or judicial review within the statutory time limits for requesting such relief, so the decisions declaring their licenses void are final.

⁴⁸ See *Applications of Space Station System Licensee, Inc., et al.*, Memorandum Opinion and Order, DA 02-307, 17 FCC Rcd 2271, 2275, ¶ 5 (2002) (*Iridium Transfer of Control Order*).

⁴⁹ For purposes of this Order, we refer to the buyer and assignee of the Iridium system and its licenses and authorizations as "Iridium." Iridium consists of two holding companies, Iridium Holdings LLC and Iridium Carrier Holdings LLC, and three subsidiaries. Iridium Holdings LLC directly owns Iridium Satellite LLC, which, in turn, directly owns Iridium Constellation LLC. Iridium Carrier Holdings LLC directly owns Iridium Carrier Services, LLC. See *Iridium Transfer of Control Order*, 17 FCC Rcd at 2274, ¶ 4.

⁵⁰ *Id.* at 2275, ¶ 7.

⁵¹ See *id.*

23. In February 2002, the parent of the companies holding the Globalstar satellite license, the license for Globalstar's U.S. gateway station, and the blanket license for operation of Globalstar mobile terminals in the United States, filed for Chapter 11 bankruptcy protection. During the pending pleading cycle for the *Big LEO Spectrum Sharing NPRM*, ICO Global Communications (Holdings) Limited (ICO) made a failed attempt to merge with Globalstar.⁵² In November 2003, the U.S. Bankruptcy Court approved a sale, subject to Commission approval, of the Globalstar system's assets to New Operating Globalstar LLC (hereinafter referred to as Globalstar). Subsequently, the International Bureau granted the assignment of Globalstar's MSS-related authorizations and licenses from Globalstar, L.P. and LQL Licensee, Inc. to Globalstar on March 8, 2004.⁵³

D. Ancillary Terrestrial Component Order

24. In 2003, the Commission adopted the *ATC Order*, granting MSS licensees the authority to implement ATCs to be integrated into MSS networks in MSS bands, including the Big LEO bands.⁵⁴ ATCs allow MSS operators to expand their communications services to urban areas and in buildings where the satellite signal is weak by re-using their assigned frequencies.⁵⁵ In the Big LEO bands, the Commission has limited ATC operations "to the 1610-1615.5 MHz, 1621.35-1626.5 MHz and 2492.5-2498 MHz bands and to the specific frequencies authorized for use by the MSS licensee that seeks ATC authority."⁵⁶

E. Current Use of 2495-2500 MHz Band

25. The 2495-2500 MHz band is a subset of a larger band at 2483.5-2500 MHz that is allocated to MSS (space-to-Earth) and radiodetermination-satellite (space-to-Earth) services on a primary basis, and is designated for industrial, scientific and medical (ISM) applications.⁵⁷ Under the current rules, the 2483.5-2500 MHz band may also be used by grandfathered stations in the broadcast auxiliary service (BAS) and private radio service per non-Federal Government footnote NG147.

26. A database search shows that the 2495-2500 MHz band currently includes 108 licenses for BAS and private radio services, which are grandfathered on a primary basis: 1 local television

⁵² See *New Globalstar Corporation Seeks Consent to Assignment and Transfer of Control of Licenses and Authorizations Held by Globalstar, L.P. Subsidiaries and Affiliates*, IB Docket No. 03-136, Public Notice, DA 03-1932, 18 FCC Rcd 11538 (Int'l Bur. 2003); see also *Satellite Communications Services Information Regarding Actions Taken*, Public Notice, Report No. SES 00567, at 25-26 (Int'l Bur., rel. Jan. 7, 2004); *Policy Branch Information*, Public Notice, DA 04-18, 19 FCC Rcd 77, 79 (Int'l Bur. 2004) (withdrawing the application for assignment and transfer of control).

⁵³ See *International Authorizations Granted*, IB Docket No. 04-4, Public Notice, DA 04-628, 19 FCC Rcd 4079 (Int'l Bur. 2004). The Globalstar system has remained in continuous operation since it began providing service.

⁵⁴ See *Flexibility for Delivery of Communications by Mobile Satellite Service Providers in the 2 GHz Band, the L-Band, and the 1.6/2.4 GHz Bands*, IB Docket No. 01-185, Report and Order and Notice of Proposed Rulemaking, FCC 03-15, 18 FCC Rcd 1962, 1964-2087, ¶¶ 1-4, 6-260 (2003) (*ATC Order*).

⁵⁵ *Id.* at 1971, ¶ 14.

⁵⁶ 47 C.F.R. § 25.149(a)(2)(iii).

⁵⁷ See 47 C.F.R. § 2.106; see also footnotes 5.150 and US41. Radiocommunication services operating in a band designed for ISM use must accept harmful interference which may be caused by these applications.

transmission license, 12 point-to-point microwave, private-industrial business licenses, 4 conventional public safety pool licenses, 12 TV intercity relay licenses, 78 TV pickup licenses, and 1 TV translator relay license.

F. Big LEO Spectrum Sharing NPRM

27. In the *Big LEO Order*, the Commission reserved the option to re-examine the Big LEO spectrum sharing plan in a rulemaking based on the circumstances at that time and to make additional findings to refine the use of the Big LEO bands to better serve the public interest.⁵⁸ In addition, the Commission also left open the possibility of providing an opportunity for additional MSS entry in Big LEO spectrum.⁵⁹ In keeping with the previously-stated intention to reconsider the Big LEO band plan in the event only one of the originally authorized CDMA systems was implemented, we issued the Notice of Proposed Rulemaking that initiated this proceeding (*Big LEO Spectrum Sharing NPRM*).⁶⁰ The *Big LEO Spectrum Sharing NPRM*, which was incorporated into the same document as the *ATC Order*, invited public comment on relevant proposals for spectrum in the Big LEO bands and prompted interested parties to provide detailed information as to current Iridium and Globalstar operations and future spectrum requirements for each system.⁶¹ The Commission also invited comment on: (1) the feasibility of CDMA MSS/TDMA MSS spectrum sharing in the 1610-1626.5 MHz band; (2) the potential impact of downward expansion of the TDMA MSS service-link band on RAS and GLONASS; (3) possible reassignment or reallocation of a portion of the 2483.5-2500 MHz band currently reserved for Big LEO CDMA downlinks; and (4) implementation of ATC in additional portions of the Big LEO bands.⁶²

G. TDMA Use of CDMA L-Band Spectrum Under Special Temporary Authority

28. Beginning in April 2003, Iridium filed a series of requests for special temporary authority (STA) to use an additional 2.5 megahertz of spectrum in the 1618.85-1621.35 MHz band, contending that a temporary expansion of the available spectrum for Iridium operation was necessary to accommodate demand for Iridium service by U.S. and Coalition Forces in the Middle East region.⁶³ Although

⁵⁸ *Big LEO Order*, 9 FCC Rcd at 5959-61, ¶¶ 54-57.

⁵⁹ *Id.* at 5960, ¶ 55.

⁶⁰ *Review of the Spectrum Sharing Plan Among Non-Geostationary Satellite Orbit Mobile Satellite Service Systems in the 1.6/2.4 GHz Bands*, IB Docket No. 02-364, Report and Order and Notice of Proposed Rulemaking, FCC 03-15, 18 FCC Rcd 1962, 1966-1967, 2087-2092, ¶¶ 5, 261-277 (2003) (*Big LEO Spectrum Sharing NPRM*). The *Big LEO Spectrum Sharing NPRM* also granted, in part, a petition for rulemaking filed by Iridium asking the Commission to revise its rules to allow TDMA systems to operate in additional spectrum in the 1610-1626.5 MHz band. See Petition for Rulemaking of Iridium Satellite LLC (filed July 26, 2002) (Iridium Petition). Because only one CDMA system had been implemented, Iridium urged the Commission to shift the dividing line between the segment reserved for CDMA uplink transmission and that reserved for bi-directional TDMA operation from 1621.35 MHz to 1615.5 MHz, which would increase the available bandwidth for Iridium's TDMA service links from 5.15 megahertz to 11 megahertz. Iridium asserted that it would need the additional spectrum to meet anticipated growth in demand for Iridium service. Iridium Petition at 7-12.

⁶¹ *Big LEO Spectrum Sharing NPRM*, 18 FCC Rcd at 2089-2092, ¶¶ 267-273.

⁶² *Id.* at 2090-2092, ¶¶ 269-273.

⁶³ Letter from Jennifer D. Hindin, Counsel for Iridium, to Thomas S. Tycz, Chief, Satellite Division, International Bureau, FCC (dated April 14, 2003); Letter from Peter D. Shields, Counsel for Iridium, to Thomas S. Tycz, Chief, (continued....)

Globalstar initially agreed to the STAs, it questioned Iridium's need for the additional spectrum.⁶⁴ The International Bureau's Satellite Division (Division) granted the STA requests, finding that such action was necessary to accommodate vital communications needs of U.S. and Coalition Forces. In June 2003, Iridium again requested an extension of its temporary authority to use the additional spectrum.⁶⁵ Iridium acknowledged, however, that while it continued to experience high levels of demand for its service, the demand had subsided. Thus, Iridium requested additional temporary authority to use less spectrum, 1.25 megahertz, at 1620.1-1621.35 MHz. Globalstar opposed this request stating, among other things, that its own system was experiencing harmful interference that "appears" to arise from Iridium's use of the Globalstar channels.⁶⁶ The Division granted Iridium an additional 30 days to use the spectrum, finding it allowed Iridium to provide critical support to U.S. Forces in the Middle East region. The Division also stated that Iridium's reduction in use, to 1.25 megahertz of spectrum, was an appropriate response to lower traffic levels and concerns with possible interference raised by Globalstar. The Division further directed Iridium to have the capability to cease operations within 24 hours notice from the Commission.⁶⁷

29. Thereafter, in response to another request from Iridium, the Division granted Iridium authority to use the 1620.1-1621.35 MHz band for 120 days. The Division noted that the Defense Systems Information Agency of the DOD supported Iridium's use of the additional spectrum, stating that it had a positive effect on services provided to U.S. and Coalition Forces.⁶⁸ In the Order, the Division noted that there has been "no demonstrated interference" between the Iridium and Globalstar systems. The Division authorized the spectrum use conditioned upon the requirement that Iridium file a monthly status report on system loading, and that Iridium operate on a co-equal basis with Globalstar in the Middle East region and on a non-harmful interference basis in areas outside the Middle East region.⁶⁹ In December 2003 and June 2004, for essentially the same reasons and subject to the same conditions, the Division granted authority for continued Iridium operation in the 1620.10-1621.35 MHz band, until November 8, 2004 or until levels of usage and U.S. Government requirements no longer justify the need for the additional spectrum.⁷⁰

(Continued from previous page)

Satellite Division, International Bureau, FCC (dated April 25, 2003); *Iridium Request for Special Temporary Authority to Provide MSS in the 1618.85-1621.35 MHz Frequency Band Until May 13, 2003* (filed May 2, 2003).

⁶⁴ Letter from William F. Adler, Counsel for Globalstar, to Thomas S. Tycz, Chief, Satellite Division, FCC (dated May 1, 2003).

⁶⁵ Request for Extension of Special Temporary Authority for Iridium Constellation LLC to Provide Global Mobile Satellite Service in the 1620.10-1621.35 MHz Frequency Band (filed June 9, 2003).

⁶⁶ Letter from William D. Wallace, Counsel for Globalstar, to Thomas S. Tycz, Chief, Satellite Division, FCC (dated June 11, 2003).

⁶⁷ *Iridium Constellation, LLC and Iridium, US LP, Request for Special Temporary Authorization*, Order, DA 03-1949 (Sat. Div., Int'l Bur. 2003).

⁶⁸ *Modification of Licenses held by Iridium Constellation, LLC and Iridium, US LP*, Order, DA 03-2906, 18 FCC Rcd 20023, (Sat. Div., Int'l Bur. 2003).

⁶⁹ *Id.* at 20027. The Satellite Division also stipulated that the temporary authorization was "without prejudice to Commission action" in this rulemaking proceeding. *Id.* at 20028, ¶ 13.

⁷⁰ *Iridium Constellation, LLC, Request for Special Temporary Authority*, Order, DA 03-3926, 18 FCC Rcd 25814 (Sat. Div., Int'l Bur. 2003); *Iridium Constellation, LLC, Request for Special Temporary Authority*, Order, DA 04-1669 (Sat. Div., Int'l Bur., rel. June 9, 2004).

III. DISCUSSION

A. The Need to Reassess the Current Band Plan

30. In the *Big LEO Spectrum Sharing NPRM*, we tentatively concluded that it was appropriate to reassess the current Big LEO spectrum sharing plan and sought comment on this tentative conclusion.⁷¹ We affirm our conclusion that conditions have been met to justify a reassessment of the existing band plan.

31. Iridium, Globalstar and ICO appear to disagree over whether certain conditions have been met to justify reassessment of the current Big LEO spectrum sharing plan. According to Iridium, the time is ripe for reassessing the Big LEO spectrum sharing plan because the Commission determined in the *Big LEO Order* that "it would be necessary to reassign Big LEO spectrum . . ." if only one CDMA licensee out of the original four CDMA licensees implemented its system.⁷² In addition, Iridium states that, in a 1996 agreement, Iridium, Globalstar, and Odyssey noted the plan was subject to change if only a single entity implemented a CDMA-based Big LEO satellite system.

32. Joint Commenters Globalstar and LQL (collectively referred to as Globalstar) and ICO disagree with Iridium's interpretation of the Commission's actions in the *Big LEO Order*. According to these commenters, the operation of only one CDMA system does not "necessitate" modification of the band plan at this time.⁷³ In particular, Globalstar claims that when the Commission adopted the Big LEO band plan in 1994, it stated that it might consider reassignment of 3.1 megahertz of Big LEO L-band spectrum based on the circumstances existing when Big LEO systems commenced operations.⁷⁴ However, the Commission declined to find that an automatic halving of the L-band spectrum was appropriate if only one CDMA and one TDMA system became operational.⁷⁵ ICO argues that, in the *Big LEO Order*, the Commission decided to postpone reassessment of the current band plan "until the occurrence of certain contingencies alleviating inter-service sharing constraints in the L-band."⁷⁶ ICO claims, however, that these contingencies have not occurred because Globalstar must still comply with restrictions imposed to protect RAS and GLONASS from harmful interference in the L-band.⁷⁷

33. We agree that the *Big LEO Order* did not require an automatic reassignment of spectrum in the event that only one CDMA provider implements service. We disagree, however, with those commenters that suggest that we have no basis for reassessing the current band plan at this time. In particular, we disagree with ICO that restrictions must be lifted with regard to protecting RAS and GLONASS before the Commission may proceed with a band plan reassessment. As noted above, the

⁷¹ *Big LEO Spectrum Sharing NPRM*, 18 FCC Red at 2087, 2089, ¶¶ 261, 266.

⁷² Iridium Comments at 6.

⁷³ Joint Reply Comments of L/Q Licensee, Inc., Globalstar, L.P. and Globalstar USA, L.L.C. (Joint Reply Comments) at 3; ICO Reply Comments at 12.

⁷⁴ Joint Reply Comments at 3.

⁷⁵ Joint Reply Comments at 3-4.

⁷⁶ ICO Reply Comments at 12.

⁷⁷ *Id.*

Commission stated that it would reassess the current band plan if: (1) no CDMA system is licensed; (2) only one CDMA system is licensed; or (3) two or more CDMA systems are licensed but only one CDMA operator successfully implements its system.⁷⁸ Currently, Globalstar holds the only remaining CDMA license out of the four CDMA licenses originally granted, thereby meeting the third condition. Thus, we believe that reassessing the current band plan at this time is appropriate.

B. The Revision of L-Band Spectrum in the Big LEO Band Plan

1. Iridium's Request for More L-Band Spectrum

34. In the *Big LEO Spectrum Sharing NPRM*, we sought comment on whether the Big LEO band plan should be modified in response to Iridium's petition for rulemaking seeking additional spectrum in the L-band.⁷⁹ In its comments, Iridium argues that although it uses its spectrum efficiently in the L-band, 5.15 megahertz of spectrum is insufficient to satisfy its existing customers' needs, to meet increasing demand for MSS services, or to introduce new services such as ATC service that will allow Iridium to remain competitive in the provision of MSS.⁸⁰ For example, according to Iridium, it is unable to handle geographically dense traffic loads that exceed 180 to 200 users with single beam loading. Iridium states that, with an additional 5.35 megahertz of L-band spectrum, it could handle 350 to 450 users with single beam loading.⁸¹ Furthermore, Iridium claims that the Commission's grant of Iridium's STA demonstrates that its system limitations result from a lack of spectrum.⁸²

35. Iridium also argues that the current band plan places it at a competitive disadvantage because it is licensed to operate in merely 5.15 megahertz of spectrum as compared to Globalstar, which, counting both the L-band and S-band CDMA spectrum, is licensed to operate in 27.85 megahertz of spectrum.⁸³ Iridium claims that, as a result of this imbalance, Globalstar offers voice services at up to 8 kilobits per second (kbps), and data services at up to 9.6 kbps, while Iridium is forced to cut voice and data rates in half throughout its network.⁸⁴ Iridium argues, therefore, that the Commission must modify the Big LEO spectrum band plan to create spectrum parity among the licensees, which would ensure a competitive marketplace for MSS.⁸⁵ Iridium claims that its proposed band plan, which would divide the Big LEO spectrum into three "comparably sized blocks" for a CDMA system, TDMA system and undetermined

⁷⁸ *Big LEO Order*, 9 FCC Rcd at 5959, n.65; see also *supra* ¶ 18.

⁷⁹ See Iridium Petition at 4-5 (initially requesting 5.85 megahertz of additional spectrum in the 1.6 GHz or L-band). In its subsequent filings, however, Iridium requests 5.35 megahertz of additional spectrum in the 1.6 GHz band. Iridium Comments at 32. Thus, we base our analysis on Iridium's request for 5.35 megahertz of additional spectrum.

⁸⁰ Iridium Comments at 10-30; Iridium Reply Comments at 6-9.

⁸¹ Iridium Comments at 15. An Iridium beam covers approximately ten-thousand square miles.

⁸² Iridium Reply Comments at 5.

⁸³ Iridium Comments at 7.

⁸⁴ *Id.* at 7-8. Iridium is comparing the data rate of the voice services used by Globalstar and Iridium. A faster data rate generally results in a clearer reproduction of the voice.

⁸⁵ *Id.* at 30-32.

services, respectively, would ensure "competitive parity."⁸⁶ Iridium contends that adopting its band plan will serve the public interest by allowing Iridium to implement new services and meet customers' needs.⁸⁷

36. Globalstar, along with other commenters, opposes Iridium's proposed band plan or any other change to the existing Big LEO band plan.⁸⁸ In particular, Globalstar claims that it needs access to all of its licensed channels, nine channels in the L-band and thirteen channels in S-band, due to "the need for channel diversity, the regulatory restrictions on the specific frequencies, and anticipated capacity requirements."⁸⁹ Globalstar states that it offers three types of services that require multiple channels: voice/data service for non-aeronautical users; aviation service with higher data rates for rapidly-moving users; and simplex telemetry services.⁹⁰ According to Globalstar, in different geographic areas, it would assign at least one channel for ATC, two channels for aviation, and two channels for remote telemetry, leaving only four channels for voice and data transmissions in the L-band or return link.⁹¹ In addition, Globalstar claims that inter-service sharing with RAS and out-of-band (OOB) emissions limits for protecting GPS and GLONASS restricts Globalstar's spectrum usage in the 1610-1615 MHz band.⁹²

⁸⁶ *Id.* at 4-5. Under Iridium's proposed band plan, Iridium would receive at least 5.35 megahertz of additional spectrum while 10 megahertz of CDMA MSS spectrum would be "reclaimed" for other purposes. *Id.* at 25-26, 36.

⁸⁷ *Id.* at 31-34.

⁸⁸ See generally Joint Comments of L/Q Licensee, Inc., Globalstar, L.P. and Globalstar USA, L.L.C. (Joint Comments); Joint Reply Comments; Lockheed Martin Corporation Comments (Lockheed Comments); Comments of Globalstar Canada Company (Globalstar Canada Comments); Comments of the Official Creditors' Committee of Globalstar, L.P. (Globalstar Committee Comments). According to the Globalstar Committee, Iridium has failed to demonstrate that it has the capacity constraints to justify a change in the band plan. Globalstar Committee Comments at 4.

⁸⁹ Joint Comments at 6.

⁹⁰ *Id.* at 7.

⁹¹ *Id.* at 8; see also Letter from William Wallace, Counsel for Globalstar, to Marlene H. Dortch, Secretary, FCC, IB Docket No. 02-364, Attach., Big LEO Band Plan at 4-5 (dated Feb. 6, 2004) (stating that Globalstar requires at least four or five channels for standard voice and data services and two channels for simplex telemetry service). Globalstar also explains that, to satisfy Federal Aviation Administration standards for its aviation equipment, it must operate its aviation services above 1616 MHz in the L-band, and that market demands require Globalstar to allocate two separate channels for aviation services. Joint Comments at 7; see also Letter from Thomas Gutierrez, Counsel for Globalstar, to Marlene H. Dortch, Secretary, FCC at 2 (dated June 3, 2004) (*Globalstar June 3 Ex Parte*).

⁹² Joint Comments at 10-11; see also Globalstar Committee Comments at 3-4. According to Globalstar, it must protect RAS observations at 1610-1613.8 MHz by establishing exclusion zones because mobile earth terminals (METs) may not operate with RAS on a co-channel basis during that time. Globalstar states that, as a result, transmissions from METs must be moved into one of two frequency blocks. In particular, Globalstar states that MET transmissions will be placed in spectrum at 1616.2 MHz or higher for certain exclusion zones and in spectrum at 1613.8 MHz or higher for smaller exclusion zones. Joint Comments at 10-11. Globalstar also states that the protection requirements imposed hinders its ability to transmit power and distribute calls. *Id.* at 11.

Globalstar, therefore, claims that a reduction in L-band spectrum could hinder Globalstar's ability to provide its services.⁹³

37. Globalstar further argues that Iridium does not need the additional spectrum in the L-band. First, Globalstar argues that Iridium does not make full and efficient use of the 5.15 megahertz of spectrum currently assigned to Iridium in the L-band.⁹⁴ Based on Globalstar's observations, Iridium's capacity in the 5.15 megahertz appears to be limited by design and spectrum usage decisions.⁹⁵ Second, Globalstar claims that Iridium has failed to provide evidence in the record to demonstrate that the constraints on its operating capacity are caused by a lack of spectrum.⁹⁶ For example, according to Globalstar, other factors may be limiting the capacity of Iridium's system because Iridium has failed to show that all capacity on the satellites has increased now that Iridium has more spectrum under the STA.⁹⁷ Globalstar also points out that Iridium already has access to 2 GHz MSS spectrum.⁹⁸ Globalstar further argues that more L-band spectrum would still not enable Iridium to implement ATC because Iridium's bi-directional system design prevents it from offering ATC.⁹⁹ In addition, Globalstar argues that, although Iridium complains that the band plan requires parity, the current band plan was adopted to accommodate Iridium.¹⁰⁰ Globalstar argues that Iridium was offered, but refused, a spectrum assignment at S-band for its downlinks; refused to use a spectrum sharing technology; and insisted on a band plan that accommodated its highly-specialized technology.¹⁰¹

38. Lockheed Martin Corporation (Lockheed) opposes modification of the current spectrum plan.¹⁰² According to Lockheed, the original spectrum plan was a valid compromise and should not be overturned. In particular, Lockheed argues that, because new CDMA MSS systems can share across the frequency band with Globalstar based on the flexibility of CDMA technology, the current split allows

⁹³ Joint Comments at 11; *see also* Globalstar Committee Comments at 6 ("Reducing the spectrum available to Globalstar would severely hinder Globalstar's ability to offer competitive MSS services . . . and will hamper Globalstar's efforts to deploy an ATC platform that will enable truly ubiquitous network coverage.").

⁹⁴ Joint Comments at 12-16. The Globalstar Committee argues that giving Iridium more spectrum does not serve the public interest because, given Iridium's small customer base, any capacity constraints would likely be caused by the Iridium TDMA system's inefficient use of spectrum. *See* Globalstar Committee Comments at 6-7; *see also* Globalstar Committee Reply Comments at 3 (stating that "adoption of Iridium's proposed band plan would essentially reward additional spectrum to Iridium for implementing a spectrally inefficient system – a result that is neither logical nor in the public interest.").

⁹⁵ Joint Comments at 14.

⁹⁶ *See* Joint Reply Comments at 10-19; *see also* Globalstar Committee Reply Comments at 4-5.

⁹⁷ Joint Reply Comments at 18-19.

⁹⁸ Joint Comments at 30.

⁹⁹ *Id.* at 15-16; Joint Reply Comments at 17-18.

¹⁰⁰ *Id.* at 2-4 (stating that Iridium "voluntarily insisted upon the terms and conditions underlying the current band plan.").

¹⁰¹ Joint Comments at 22-24.

¹⁰² Lockheed Comments at 4-5.

new entrants to use the spectrum without requiring any significant changes to the operation of existing systems.¹⁰³ The spectrum that has been allocated for TDMA does not easily support use by new entrants.¹⁰⁴ Lockheed concludes that, absent a persuasive showing that TDMA-based systems need more spectrum, the Commission should not reassess the existing spectrum sharing plan.¹⁰⁵

39. Globalstar Canada claims that increasing spectrum access in the L-band for TDMA MSS will have an adverse impact on Industry Canada's ability to manage Big LEO MSS spectrum in Canada.¹⁰⁶ Globalstar Canada argues that allowing Iridium to occupy additional spectrum above approximately 1616 MHz will hinder Globalstar Canada's ability to grow, particularly as Globalstar Canada prepares to file an application for additional spectrum above 1616.2 MHz in response to subscribership growth in the Canadian public safety/aviation market.¹⁰⁷

40. Blue Sky opposes Iridium's band plan proposal, but supports a change in the Big LEO band plan.¹⁰⁸ Blue Sky argues that the modified band plan should require Iridium and Globalstar to share the burden of coordinating operations with RAS and GPS services in the lower portion of the L-band. In particular, Blue Sky proposes that the Commission assign spectrum from approximately 1610-1613.8 MHz to Iridium and spectrum from approximately 1613.8-1621.2 MHz to Globalstar.¹⁰⁹ Blue Sky argues that, as a result, both licensees would receive the same amount of Non-Inter-service Sharing Channels in the Big LEO uplink band.¹¹⁰ Blue Sky explains that "special consideration" should not be given "to accommodate and expand Iridium's 'unique' and highly inefficient use of a Band Plan that was clearly designed to promote [frequency division duplexing] technologies."¹¹¹

41. Some commenters express concern regarding Iridium's possible harmful interference if the Commission grants Iridium access to additional spectrum in the L-band.¹¹² Specifically, Globalstar Canada argues that Iridium's use of spectrum above 1616.2 MHz would pose harmful interference with Globalstar Canada's operations at approximately 1616.2-1617.4 MHz and below.¹¹³ Globalstar argues

¹⁰³ *Id.*

¹⁰⁴ *Id.* at 5.

¹⁰⁵ *Id.*

¹⁰⁶ Globalstar Canada Comments at 2.

¹⁰⁷ *Id.* at 3.

¹⁰⁸ See generally Comments of Blue Sky Information Services in Response to the Notice of Proposed Rulemaking (Blue Sky Comments).

¹⁰⁹ *Id.* at 6.

¹¹⁰ *Id.* at 7.

¹¹¹ See *id.* at 4-5.

¹¹² See, e.g., Cornell University Comments at 4-6.

¹¹³ Globalstar Canada Comments at 3. Globalstar Canada contends that Iridium traffic would violate Canadian law and that a grant of spectrum to Iridium at 1619.9-1621.2 MHz and below would have an extra-territorial effect, particularly given the Iridium system's technical limitations. *Id.*

that granting Iridium the additional spectrum will harm RAS because Iridium is unable to control its frequency assignments on a regional basis.¹¹⁴ Cornell University contends that the incidence of harmful interference will depend on the proximity of Iridium's transmissions to the 1610.6-1613.8 MHz RAS band, the number of separate channels used by Iridium and the density of Iridium's traffic.¹¹⁵ Cornell University further argues that the Commission only should grant Iridium use of part of the 5.85 megahertz of spectrum in the frequencies farthest away from the RAS band, and that any assignment of closer frequencies should be conditioned on results of tests performed to determine the impact of such an assignment.¹¹⁶ Subsequently, Cornell University filed a supplemental letter which stated that Iridium's current use of additional spectrum under the STA did not cause the harmful interference experienced by the Arecibo Radio Astronomy Observatory.¹¹⁷

42. Iridium disagrees with Globalstar's comments and claims that its band plan will not hinder Globalstar's ability to provide services in the L-band.¹¹⁸ According to Iridium, Globalstar's own statements indicate that it has excess spectrum.¹¹⁹ For example, Iridium claims that Globalstar stated that it had less than 25,000 subscribers in the United States as of the second quarter of 2003 and claims that it is efficiently and fully using the 11.35 megahertz of L-band spectrum and 16.5 megahertz of S-band spectrum. However, according to Iridium, Globalstar also stated that 5.15 megahertz of spectrum would be sufficient for Iridium to provide service to at least 500,000 subscribers in the United States.¹²⁰ In addition, Iridium states that, although Globalstar allegedly needs to use spectrum in 1616.2-1621.2 MHz for aviation services, Globalstar has not experienced any disruptions in aviation service while Iridium has operated in 1618.7-1619.9 MHz under the STA.¹²¹

43. Iridium also disagrees with commenters regarding the possibility of harmful interference and Iridium's ability to provide ATC. Iridium states that its band plan will not pose harmful interference to other users, such as RAS and GLONASS, in the L-band. With regard to RAS, Iridium argues that access to more spectrum under its band plan will enable it to better utilize a functionality that provides for significantly reduced OOB emissions.¹²² With regard to GLONASS, Iridium suggests that after GLONASS shifts frequencies in 2005¹²³ and after Globalstar amends its operations to take the GLONASS frequency shift into account, then Iridium will be able to obtain additional spectrum while

¹¹⁴ See Joint Reply Comments at 19-22.

¹¹⁵ Cornell University Comments at 4.

¹¹⁶ *Id.* at 7-8.

¹¹⁷ See Letter from Paul J. Feldman, Counsel for Cornell University, to James Ball, Chief, Policy Division, International Bureau, FCC (dated Dec. 17, 2003).

¹¹⁸ Iridium Reply Comments at 9.

¹¹⁹ *Id.*

¹²⁰ *Id.* at 9-10.

¹²¹ *Id.* at 10-11.

¹²² *Id.* at 30.

¹²³ GLONASS is expected to shift frequencies by 2005 so that its highest L-band frequency is 1605.375 MHz.

protecting GLONASS. Iridium also suggests that Globalstar could use better filters on its mobile terminals to protect GLONASS.¹²⁴ Iridium further contends that the use of a 0.65 megahertz guard band, as suggested under its proposed band plan, would help ensure that its system could operate without potential harmful interference to Globalstar's system.¹²⁵ Moreover, Iridium claims that it already has demonstrated it can protect adjacent channel license operations because it has operated without any adverse impact under the STA and has complied with the Memorandum of Understanding created to protect RAS.¹²⁶ Lastly, Iridium argues that it has the capability of providing ATC services by utilizing a time division duplex format coupled with the additional spectrum.¹²⁷

2. Revised L-Band Sharing Plan

44. We establish a new band sharing plan in which the TDMA operators may share the 3.1 megahertz of spectrum with CDMA operators at 1618.25-1621.35 MHz. Specifically, TDMA operators will share this band on a co-primary basis in the uplink (Earth-to-space) direction, and on a secondary basis in the downlink (space-to-Earth) direction. For the reasons discussed below, we find that sharing the 3.1 megahertz would best serve the public interest.

45. First, sharing this spectrum should promote spectral efficiency by increasing the number of MSS licensees that will use this spectrum, particularly at a time when the demand for spectrum has increased. In fact, we believe that promoting efficient spectrum use through sharing spectrum is consistent with our overall spectrum policy. For example, in the *Cognitive Radio Technologies NPRM* released in December 2003, we recognized that implementing cognitive radio technologies in terrestrial or satellite systems could increase the efficient use of spectrum by facilitating greater spectrum sharing through improved coordination techniques.¹²⁸ By relying on cognitive technology to promote real-time spectrum coordination, "actual occurrence of 'worst case' interference conditions could be anticipated and avoided by changing terrestrial paths, changing satellite uplink or downlink paths, modifying [radio frequency] parameters, or through other techniques."¹²⁹ As a result of these tentative findings, we sought comment on ways to encourage dynamic coordination approaches that would facilitate spectrum sharing.¹³⁰ Thus, we view spectrum sharing as an approach that should be implemented, and improved, wherever possible.

46. This spectrum sharing plan represents a more technology neutral approach to assigning spectrum, thereby not giving a preference to a specific technology. Consequently, this sharing plan

¹²⁴ Iridium Reply Comments at 31.

¹²⁵ *Id.* at 33.

¹²⁶ *Id.* at 29.

¹²⁷ *Id.* at 8-9.

¹²⁸ *Facilitating Opportunities for Flexible, Efficient, and Reliable Spectrum Use Employing Cognitive Radio Technologies, Authorization and Use of Software Defined Radios*, ET Docket No. 03-108, Notice of Proposed Rulemaking and Order, FCC 03-322, 18 FCC Rcd 26859, 26860, ¶ 1, 26885-86, ¶ 72 (2003) (*Cognitive Radio Technologies NPRM*). Coordinated spectrum sharing allows more users to utilize a particular frequency band. *Id.*

¹²⁹ *Id.* at 26885-86, ¶ 72.

¹³⁰ *Id.* at 26886, ¶ 73.

should promote more market-driven, as opposed to regulatory-driven, uses of the spectrum. As discussed in prior Commission decisions, we consider technical neutrality to be an important spectrum management objective.¹³¹

47. In addition, we find that the record in this proceeding supports a finding that sharing L-band spectrum would be more beneficial than granting TDMA MSS operators exclusive access to additional L-band spectrum. Both the CDMA and the TDMA MSS operator set forth compelling arguments for utilizing the spectrum, so we believe that sharing the spectrum would be the most equitable solution at this time. For example, based on our review of the record, Iridium's need for spectrum appears to be more sporadic and geographic-specific. In particular, when Iridium's system experiences a high level of traffic in a specific geographic area, having more spectrum will alleviate that traffic. As discussed previously, Iridium's system experienced high traffic levels last year in Iraq and received more spectrum in the L-band under the STA. When that traffic decreased, however, Iridium's need for that same amount of spectrum also decreased. Thus, we decline to take spectrum from a competitor on a worldwide basis for what appears to be a sporadic and geographically-based need.

48. With regard to the amount of sharing to allow, we limit sharing to 3.1 megahertz in the L-band. First, encumbrances in the lower portion of the L-band, for protecting RAS, for example, restricts the CDMA MSS operators' ability to provide services in that spectrum, particularly aviation services. In addition, we remain consistent with our decision in the *Big LEO Order* in which we chose to consider reallocating 3.1 megahertz of L-band spectrum.¹³² Arguments, however, have been set forth regarding whether the CDMA and TDMA MSS operators could share an additional 2.25 megahertz, totaling 5.35 megahertz of shared spectrum in the L-band at 1616-1621.35 MHz. We defer a decision on this issue to a *Further Notice* in order to obtain a more detailed record.¹³³

¹³¹ See *Establishment of Policies and Service Rules for the Non-Geostationary Satellite Orbit, Fixed Satellite Service in the Ka-Band*, IB Docket No. 02-19, Report and Order, FCC 03-137, 18 FCC Rcd 14708, 14711, ¶ 10 (2003) (adopting a sharing plan for licensees in Ka-Band spectrum designated for NGSO fixed satellite service operations, in which the Commission stated that the sharing plan had to be, among other things, technology neutral so that the Commission would not favor any particular technology or operational method); see also *Establishment of Policies and Service Rules for the Non-Geostationary Satellite Orbit, Fixed Satellite Service in the Ku-Band*, IB Docket No. 01-96, Report and Order, FCC 02-123, 17 FCC Rcd 7841, 7850 (2002) (same). In addition, adopting a band plan that requires spectrum users to share is consistent with the report of the Commission's Spectrum Policy Task Force regarding the need for more flexibility in spectrum policy. See Spectrum Policy Task Force Report.

¹³² *Big LEO Order*, 9 FCC Rcd at 5960, ¶ 55. As a related matter, we find that we are not constrained by the rules adopted in the *Space Station Licensing Reform First Report and Order*. See *Amendment of the Commission's Space Station Licensing Rules and Policies*, First Report and Order and Further Notice of Proposed Rulemaking in IB Docket No. 02-34 and First Report and Order in IB Docket No. 02-54, FCC 03-102, 18 FCC Rcd 10760 (2003) (*Space Station Licensing Reform First Report and Order*). The Commission adopted, among other rules, section 25.157(g), which prescribes ground rules for redistributing spectrum for NGSO satellite systems in the event of license cancellations. See 47 C.F.R. § 25.157(g). We believe, however, that the statements made in the *Big LEO Order* establish the expectations regarding that spectrum and not section 25.157(g). In fact, the Commission adopted section 25.157(g) without addressing the spectrum redistribution issues that had previously been framed in this proceeding. *Space Station Licensing Reform First Report and Order*, 18 FCC Rcd at 10787-10790, ¶¶ 60-65. Moreover, the Commission acknowledged that it could "always . . . consider initiating a rulemaking proceeding to determine whether available spectrum should be reallocated." *Id.* at 10788, ¶ 62. We chose the rulemaking option in this proceeding. Therefore, we decline to apply section 25.157(g) procedures to this proceeding.

¹³³ See *infra* Section IV.

49. We disagree with Iridium's contention that the new band plan must ensure "spectrum parity." Iridium fails to persuade us that disproportionate amounts of spectrum in the Big LEO bands prevent Iridium from providing competitive services or that Iridium's alleged competitive disadvantage justifies allocating the same amount of spectrum to TDMA and CDMA MSS operators. Indeed, we are not convinced that such "spectrum parity" in the Big LEO bands will better serve the public interest. As noted above, the spectrum within the L-band is not equally encumbered. If the Commission implemented "spectrum parity" on a pure megahertz-per-party basis, it would ignore the significant encumbrances that exist in the lower portion of the L-band due to RAS operations in that band as well as GPS receivers in the adjacent band. Moreover, the Iridium TDMA system's inability to operate MSS in the S-band further makes "spectrum parity" impractical. Thus, we reject Iridium's proposal that "spectrum parity" be a consideration in our decision today.

50. Our decision today, however, does not affect the validity of Iridium's STA operations until Iridium's license is modified to incorporate the decision made in this Order.¹³⁴ In the meantime, STA requests will continue to be resolved on their own merits on a case-by-case basis by the Commission's International Bureau.¹³⁵

3. Restrictions on TDMA MSS Operations in the L-Band

51. We note that MSS operators in the L-band must protect both the radionavigation satellite service below 1610 MHz, typified by the GPS system, and RAS within the 1610.6-1613.8 MHz band. Section 25.216 specifies the OOB emission limits necessary to protect the radionavigation satellite service from mobile earth stations (MES) operating in 1610-1626.5 MHz.¹³⁶ The current license for Iridium MESs is in the 1621.35-1626.5 MHz portion of the band and the same OOB emission limits will apply to Iridium MESs uplink operations in the 1618.25-1621.35 MHz portion of the L-band.

52. Similarly, section 25.213 specifies the inter-service requirements for protecting RAS sites from MSS emissions.¹³⁷ Specifically, section 25.213(a)(2) states that "Mobile Satellite Service space stations transmitting in the 1613.8-1626.5 MHz band shall take whatever steps are necessary to avoid harmful interference to the radio astronomy facilities listed in paragraphs (a)(1)(i) and (ii) of this section during periods of observation." This section applies to TDMA MSS operations in the 1618.25-1621.35 MHz band just as it applies to TDMA MSS operations in the 1621.35-1626.5 MHz band. The *Iridium License Order* required that all radio astronomy site coordination be complete before Iridium began its operations in the 1621.35-1626.5 MHz band.¹³⁸ In compliance with this requirement, Iridium coordinated its operations with the National Radio Astronomy Observatory, through a Memorandum of Understanding. A Coordination Agreement was also negotiated and signed by the National Astronomy and Ionosphere Center of Cornell University, the operators of the Arecibo radio astronomy site, and Iridium. These agreements specify the maximum level of unwanted emissions that Iridium may emit into

¹³⁴ See *infra* ¶ 88.

¹³⁵ See *supra* ¶¶ 28-29.

¹³⁶ See 47 C.F.R. § 25.216.

¹³⁷ See 47 C.F.R. § 25.213.

¹³⁸ *Iridium License Order*, 10 FCC Rcd at 2270, ¶ 14. "We require Motorola to complete all radio astronomy site coordination before it initiates operation of the Iridium system. We also remind Motorola that it will have to terminate operations if unacceptable interference should occur to Radio Astronomy observation." *Id.*

the 1610.6-1613.8 MHz radio astronomy band during specific time periods when radio astronomy observations are carried out at specific sites. Today's decision, after coordinating the use of this spectrum with Globalstar, will permit Iridium to operate satellite downlinks closer to the radio astronomy band at 1610.6-1613.8 MHz. We are aware that the radio astronomy community is concerned that such operations could potentially cause interference to radio astronomy observations in this band. We remind Iridium that it is still bound by the existing agreements and that it will have to terminate operations if unacceptable interference should occur to radio astronomy observations outside of the limits specified in the existing agreements. Lastly, we realize that some radio astronomy sites may not have existed, or may not have envisioned making measurements in the 1610.6-1613.8 MHz band, at the time that these agreements were made. To obtain protection from Iridium's MSS emissions, operators of those sites should request a coordination agreement with Iridium.

4. Coordination of the Shared Spectrum in L-Band

53. We believe that coordination between TDMA and CDMA MSS operators at the 1618.25-1621.35 MHz band is feasible. Although we traditionally require new entrants to request coordination from incumbent operators,¹³⁹ we do not consider Globalstar an incumbent in this regard because the Commission never granted unconditional authority for Globalstar to operate across the entire 1610-1621.35 MHz band originally assigned for shared use by multiple CDMA systems.¹⁴⁰ Under the policy we adopt here, neither TDMA MSS operators nor CDMA MSS operators will have priority over the shared spectrum at 1618.25-1621.35 MHz. Further, we find that the licensees should be able to coordinate with minimal Commission intervention, particularly because the existing TDMA and CDMA MSS operators both have been operating on some of the 3.1 megahertz of spectrum without Commission assistance since April 2003.¹⁴¹ In fact, Globalstar notes that, as a result of sharing spectrum, both the TDMA and CDMA MSS licensees have learned more about each other's systems and have been in discussions regarding a common band plan proposal for future operations.¹⁴² Thus, these operators already have demonstrated that TDMA and CDMA MSS operators may be able to share the spectrum.

54. In the unlikely event that complications arise making coordination technically infeasible, we encourage the TDMA and CDMA MSS operators to explore economic solutions for coordination such as compensating one licensee for not using a portion of spectrum in a particular geographic zone where the requesting licensee's operations require additional capacity.¹⁴³ We emphasize that the spectrum is to be used by and among Big LEO MSS operators and not to be sold on the open market. An economic solution for coordination should be based on how each licensee values the spectrum with respect to each

¹³⁹ See *Ka-Band NGSO FSS Report and Order*, 18 FCC Rcd at 14716, ¶ 25.

¹⁴⁰ See *supra* Section II.

¹⁴¹ See *supra* ¶¶ 28-29; cf. Letter from Peter D. Shields, Counsel for Iridium, to Marlene H. Dortch, Secretary, FCC at 3 (dated June 7, 2004) (*Iridium June 7 Ex Parte*) (stating that "the STA experience has conclusively demonstrated that Iridium operations within the same spectrum as Globalstar do not create harmful interference to Globalstar.").

¹⁴² Joint Reply Comments at 36-37.

¹⁴³ See, e.g., *Promoting Efficient Use of Spectrum Through Elimination of Barriers to the Development of Secondary Markets*, WT Docket No. 00-230, Report and Order and Further Notice of Proposed Rulemaking, FCC 03-113, 18 FCC Rcd 24817 (2003).

other. Additionally, we believe that the licensees will be better off if they are able to come to an agreement on their own.

55. We find that allowing TDMA and CDMA MSS operators to coordinate their operations in the 3.1 megahertz of spectrum with minimum Commission involvement is consistent with the Commission's existing approach towards spectrum management. In particular, we seek to promote flexible and market-oriented spectrum policies that will encourage more technologically innovative and economically efficient uses of the spectrum.¹⁴⁴ As we stated in the *Interference Temperature NOI/NPRM*, "[w]e need to provide opportunities for an ever increasing array of new digital radio technologies and services and to allow licensees to implement and modify these new technologies and services in accordance with the demands of market forces without having to wait for the completion of lengthy ad hoc rule makings or resolution of individual proceedings that hinge on disputes over interference."¹⁴⁵ Ultimately, we believe that greater spectrum access and efficiency will result from promoting market-oriented approaches.¹⁴⁶

56. If the TDMA and CDMA MSS operators are unable to reach an agreement, we would become involved in finding a solution. A Commission-based solution, however, may be less desirable than if the licensees had come to an agreement on their own terms. Furthermore, Commission intervention could lengthen the time frame for a resolution.¹⁴⁷

57. Finally, with regard to commenters' concerns of harmful interference, TDMA and CDMA MSS operators must coordinate the sharing of 3.1 megahertz in a manner that does not create harmful interference to other operators in the L-band. Entities may contact the Commission if harmful interference occurs and cannot be resolved without Commission assistance. In contacting the Commission, the entity alleging interference should provide detailed evidence of the harmful interference, including the source(s) of the alleged interference.

¹⁴⁴ See, e.g., *Establishment of an Interference Temperature Metric to Quantify and Manage Interference and to Expand Available Unlicensed Operation in Certain Fixed, Mobile and Satellite Frequency Bands*, ET Docket No. 03-237, Notice of Inquiry and Notice of Proposed Rulemaking, FCC 03-289, 18 FCC Rcd 25309, 25311, ¶¶ 5-6 (2003) (*Interference Temperature NOI/NPRM*). In the *Interference Temperature NOI/NPRM*, we stated that "we have implemented new licensing schemes under which bands of spectrum are assigned to licensees on a geographic basis and those licensees are provided flexibility to determine the type of services and the technologies and technical implementation designs used to provide those services. The primary restrictions we apply to technical operations under these licenses are those necessary to ensure that interference is not caused to services operating in adjacent geographic areas or in adjacent or nearby frequency bands. These restrictions typically take the form of limits on signal strength at the edge of a licensee's service area and limits on maximum transmitter power, antenna height and out-of-band emissions. These restrictions, in turn, tend to convey certain rights on the other neighboring or nearby licensees which are protected by such rules." *Id.* at 25311, ¶ 6.

¹⁴⁵ *Id.*

¹⁴⁶ See, e.g., *Facilitating the Provision of Spectrum-Based Services to Rural Areas and Promoting Opportunities for Rural Telephone Companies To Provide Spectrum-Based Services*, WT Docket No. 02-381, Notice of Proposed Rulemaking, FCC 03-222, 18 FCC Rcd 20802, 20805-20806, ¶ 3 (2003) (stating that "the Commission took steps to facilitate spectrum leasing in secondary markets, building upon existing, flexible, market-based policy efforts to encourage more efficient use of spectrum").

¹⁴⁷ For example, pursuant to our authority under sections 309 and 316, we could create a new band plan that would split the 3.1 megahertz of spectrum or hold a comparative hearing. See 47 U.S.C. §§ 309, 316.

C. Spectrum Sharing in the S-Band

58. In the *Big LEO Spectrum Sharing NPRM*, we sought comment on whether we should make any returned spectrum, including service downlink spectrum in the 2483.5-2500 MHz band, available in a second Big LEO processing round.¹⁴⁸ We also sought comment on whether we should reallocate spectrum in the 2483.5-2492.5 MHz and 2498-2500 MHz bands to other providers such as unlicensed operators or critical infrastructure licensees.¹⁴⁹ In response, we received proposals from several parties. As discussed further below, we conclude that the 2495-2500 MHz band should be designated for use by fixed and mobile terrestrial wireless service providers on a primary basis. CDMA MSS operators must accept interference from terrestrial services in this band and comply with existing PFD limits when operating in this band.

1. Proposals

59. Several commenters support allowing a portion of the S-band spectrum to be used by alternative, non-military operators.¹⁵⁰ Commenters primarily support S-band spectrum use by unlicensed operators and MDS/TTFS operators. With the exception of government use of S-band spectrum as discussed below, Iridium claims that it has no preferences regarding which service would receive the S-band reallocation, but recommends that the Commission consider analyzing these options in a further notice of proposed rulemaking.¹⁵¹ Iridium, however, opposes the introduction of a third service unless Iridium has "exclusive access to 10.5 [megahertz] of spectrum in the 1.6 GHz frequency band."¹⁵²

60. Some commenters support the use of the 2483.5-2500 MHz band by unlicensed operators.¹⁵³ According to the Licensed-Exempt Alliance (LEA), designating additional spectrum for unlicensed services is more commonplace.¹⁵⁴ LEA also claims that unlicensed spectrum is being increasingly used for "last mile" broadband deployment, particularly in areas not served by wireline technologies.¹⁵⁵ According to LEA, last-mile broadband services over unlicensed spectrum will increase as a result of the latest developments in the standards-setting process.¹⁵⁶ Thus, LEA argues that, from a consumer

¹⁴⁸ *Big LEO Spectrum Sharing NPRM*, 18 FCC Rcd at 2091, ¶ 271.

¹⁴⁹ *Id.* at 2091, ¶ 272.

¹⁵⁰ See generally Comments of the American Petroleum Institute and the United Telecom Council (API/UTC Comments); Comments of Licensed-Exempt Alliance (LEA Comments); Comments of IEEE Local and Metropolitan Area Networks Standards Committee (IEEE 802 Comments); Iridium Comments; Iridium Reply Comments. The Wireless Communications Association International, Inc. (WCA) supports any service in those portions of the S-band, be it MSS or unlicensed services, as long as such allocation did not adversely affect MDS/TTFS operators. WCA Comments at 2-3.

¹⁵¹ Iridium Reply Comments at 12.

¹⁵² *Id.* at 13.

¹⁵³ LEA Comments at 1-2.

¹⁵⁴ *Id.* at 2.

¹⁵⁵ *Id.* at 3. LEA states that at least 1,500 wireless Internet service providers are providing unlicensed broadband service to approximately 600,000 subscribers in the United States. *Id.* at 4.

¹⁵⁶ *Id.* at 7.

perspective, an increase in these services justifies allocation of additional spectrum in the 2483.5-2492.5 MHz and 2498-2500 MHz bands.¹⁵⁷ LEA argues that, in addition to providing more spectrum to unlicensed services, such an allocation would ensure that technical compatibility exists with services in the adjacent band, which would minimize interference and technical and regulatory constraints.¹⁵⁸ LEA agrees with the IEEE Local and Metropolitan Area Networks Standards Committee (IEEE 802) that the allocation would relieve frequency congestion and promote efficient use of spectrum.¹⁵⁹ IEEE 802 contends that placing unlicensed services in the 2483.5-2492.5 MHz and 2498-2500 MHz bands would not result in interference to adjacent services, including MDS and ITFS.¹⁶⁰

61. The American Petroleum Institute (API) and the United Telecom Council (UTC) (collectively referred to as API/UTC) support use of portions of the S-band by site-based or critical infrastructure licensees.¹⁶¹ In particular, API/UTC claims that a licensed, site-based critical infrastructure allocation in the S-band could be used for Internet Protocol delivery systems and other possible applications.¹⁶² API/UTC claims that the spectrum allocation should be performed on a site-based, first-come, first-served basis because such entities are exempt from spectrum auctions and not suited for geographic-area licensing.¹⁶³

62. Verizon Wireless argues that the Commission should consider reallocating portions of the S-band to MDS licensees.¹⁶⁴ Specifically, Verizon Wireless proposes two relocation options for MDS systems operating in the 2150-2160/62 MHz (2.1 GHz) band so that advanced wireless services (AWS) may be placed in that spectrum.¹⁶⁵ Verizon Wireless first suggests that MDS systems in the 2.1 GHz band could be relocated to spectrum in the 2500-2690 MHz (2.5 GHz) band as long as that band is realigned as proposed by MDS/ITFS licensees. Verizon Wireless argues that under that proposal, MDS operators would need less spectrum because more spectrally efficient, cellular-like architectures would be deployed.¹⁶⁶ IEEE 802 agrees with this proposal.¹⁶⁷ If the Commission does not adopt that proposal, Verizon Wireless recommends that the Commission relocate MDS operators to the 2490-2500 MHz

¹⁵⁷ *Id.* at 8.

¹⁵⁸ *Id.*

¹⁵⁹ *Id.* at 9 (citing IEEE 802 Comments at 3).

¹⁶⁰ IEEE 802 Reply Comments at 3; IEEE 802 Comments at 4-5.

¹⁶¹ API/UTC Comments at 4-5. According to API/UTC, "there is a critical infrastructure industry need for licensed Internet Protocol (IP) delivery systems" *Id.*

¹⁶² *Id.* at 5.

¹⁶³ *Id.* at 6.

¹⁶⁴ See generally Letter from John T. Scott, III, Counsel for Verizon Wireless, to Marlene H. Dortch, Secretary, FCC (dated July 7, 2003) (attaching Reply Comments of Verizon Wireless, ET Docket No. 00-258, filed April 28, 2003) (Verizon Wireless Reply Comments, ET Docket No. 00-258)).

¹⁶⁵ Verizon Wireless Reply Comments, ET Docket No. 00-258, at 2.

¹⁶⁶ *Id.* at 5-6.

¹⁶⁷ IEEE 802 Reply Comments at 2.

band, which is adjacent to the 2.5 GHz band occupied by MDS and ITFS licensees.¹⁶⁸ Verizon Wireless contends that MDS operators would have more contiguous spectrum. Verizon also claims that AWS providers would not need to compensate for numerous relocations because no incumbents would need to be moved from the Big LEO band.¹⁶⁹ WCA initially disagreed with Verizon Wireless that MDS licensees should be relocated to the 2490-2500 MHz portion of the S-band.¹⁷⁰ Later, however, WCA endorsed a proposal placed on the record by W.A.T.C.H. TV Company in favor of reallocating the 2494-2500 MHz band to MDS operators to assist in the relocation of MDS systems operating in the 2150-2160/62 MHz band.¹⁷¹

63. The Globalstar Committee and Globalstar oppose the use of spectrum in the S-band by other commercial operators.¹⁷² Globalstar argues that the available spectrum is needed to provide MSS in the United States.¹⁷³ Globalstar explains that the Commission has already allocated 70 megahertz of "globally-harmonized" MSS spectrum to other services, including 30 megahertz of 2 GHz spectrum to terrestrial services.¹⁷⁴ Globalstar further argues that ITU-estimated demand for MSS, 206 megahertz, cannot be met because the Commission has maintained only 143 megahertz for MSS.¹⁷⁵ Globalstar adds that the importance of MSS must not be underestimated because "MSS is the only service that can provide a relatively low-cost and readily accessible telecommunications infrastructure globally."¹⁷⁶

¹⁶⁸ Verizon Wireless Reply Comments, ET Docket No. 00-258, at 7-8; *but see* IEEE 802 Reply Comments at 2 (IEEE 802 does not support Verizon Wireless' alternative conclusion that MDS be relocated to the 2490-2500 MHz band).

¹⁶⁹ Verizon Wireless Reply Comments, ET Docket No. 00-258, at 8.

¹⁷⁰ *See, e.g.*, WCA Reply Comments at 6-7 (arguing that, despite Verizon Wireless contentions, incumbents in the 2483.5-2500 MHz band, including BAS licensees, industrial, scientific and medical (ISM) equipment, private land mobile operations and fixed microwave services would need to be moved); WCA Reply Comments at 7-9 (WCA contends that relocating MDS to 2490-2500 MHz would pose harmful interference among MDS, MSS/ATC, and BAS).

¹⁷¹ *See* Letter from Paul J. Sinderbrand, Counsel for WCA, to Marlene H. Dortch, Secretary, FCC (dated June 3, 2004); Letter from Thomas Knippen, Vice President and General Manager W.A.T.C.H. TV Company, to Michael K. Powell, Chairman, FCC (dated June 1, 2004).

¹⁷² *See generally* Joint Comments; *see also* Globalstar Committee Comments at 11 (stating that "[o]nly MSS allows customers to instantly establish communications virtually anywhere in the world without the need to establish a terrestrial infrastructure.").

¹⁷³ Joint Comments at 17.

¹⁷⁴ *Id.* at 18; *see also* Globalstar Committee Reply Comments at 6 (stating that the Commission decreased the available amount of spectrum for MSS operators from 70 megahertz (*i.e.*, 1990-2025 MHz/2165-2200 MHz) to 40 megahertz (*i.e.*, 2000-2020 MHz/2180-2200 MHz) in the 2 GHz band).

¹⁷⁵ Joint Comments at 19.

¹⁷⁶ *Id.* In its reply comments, Globalstar notes that new uses for MSS continue to be discovered, citing as an example, a contract awarded by the National Aeronautics and Space Administration to develop an Internet protocol that would allow users to connect from different platforms on land, at sea, or in the air. Joint Reply Comments at 29.

64. As for the operation of unlicensed devices in the S-band, Globalstar contends that such devices may cause harmful interference to Globalstar and could hinder its quality of service.¹⁷⁷ Lockheed agrees, claiming that unlicensed devices could cause harmful interference to existing and future satellite operations.¹⁷⁸ Globalstar also contends that commenters have failed to demonstrate any need for such spectrum.¹⁷⁹ Globalstar points out that unlicensed service advocates have overlooked recent Commission proposals for allocating an additional 225 megahertz in the 5 GHz band for unlicensed devices.¹⁸⁰ Globalstar also argues that LEA's proposal to use spectrum for providing last-mile wireless broadband access to rural areas merely replicates the services provided by Globalstar and that unlicensed wireless broadband systems are less secure due to the uncertain interference environment.¹⁸¹

65. Globalstar claims that giving MSS spectrum to licensed operators may restrict Globalstar's ability to provide a variety of services and that more time is needed to ramp-up its services in order to achieve public interest benefits.¹⁸² Globalstar also argues that API and UTC intend to use the spectrum for the same critical infrastructure services that Globalstar provides. In opposing the use of spectrum by licensed services, however, Globalstar argues that the Commission would need to license any new services on a non-interference basis with MSS and ATC phones and accept interference from those services and equipment.¹⁸³

2. S-Band Sharing Plan

66. We establish a spectrum sharing plan in the S-band in which CDMA MSS operators will share 5 megahertz of spectrum with fixed and mobile except aeronautical mobile operators at 2495-2500 MHz. Because of our decision that CDMA MSS operators now will share 3.1 megahertz of spectrum in the L-band, we find that establishing a spectrum sharing plan in the S-band serves the public interest, in part, by promoting spectral efficiency. In particular, CDMA MSS operators need approximately 1.4 megahertz of spectrum in the S-band for every 1 megahertz in the L-band to operate efficiently due to the technical and regulatory constraints associated with the two frequency bands.¹⁸⁴ The capacity of a CDMA MSS L-band uplink channel is technically limited by the total noise caused by the sum of the CDMA MSS users transmitting simultaneously in the uplink channel. In the S-band, the MSS downlink channel capacity is constrained by PFD regulatory limits placed on the satellite systems to protect any fixed system operating in the band. The ratio of the uplink channel capacity to the downlink channel capacity, for channels of equal bandwidth, is approximately 1.4 to 1. Thus, CDMA MSS operators need

¹⁷⁷ Joint Comments at 20-21.

¹⁷⁸ Lockheed Comments at 5.

¹⁷⁹ Joint Reply Comments at 31.

¹⁸⁰ *Id.*; see also Globalstar Committee Reply Comments at 7.

¹⁸¹ Joint Reply Comments at 30.

¹⁸² *Id.* at 34-35.

¹⁸³ Joint Comments at 21.

¹⁸⁴ An explanation of how the Commission calculates the 1 to 1.4 ratio is available in the Technical Appendix. See also Letter from William Wallace, Counsel for Globalstar, to Marlene H. Dortch, Secretary, FCC, Attach., Big LEO Band Plan at 12 (dated Sept. 15, 2003) (*Globalstar Sept. 15 Ex Parte*).

essentially exclusive access to about 11.5 megahertz (8.25 megahertz unshared in L-band x 1.4) in the S-band to utilize their spectrum most efficiently, i.e., to retain the 1 to 1.4 proportion of spectrum usage. Since CDMA MSS operators have essentially exclusive access to 16.5 megahertz of spectrum at S-band, 5 megahertz of that spectrum can now be shared with other services. We note that this spectrum sharing plan in the S-band is appropriate because the original Big LEO band plan was based on up to four CDMA MSS operators sharing the spectrum, and the sole remaining CDMA MSS operator should not expect to have unfettered access to 11.35 megahertz in the L-band and 16.5 megahertz in the S-band.¹⁸⁵

67. We disagree with those commenters arguing that ISM equipment would need to be moved. MSS, BAS and private radio licensees have operated in this band for many years under the provisions of footnote 5.150 of the ITU radio regulations without significant interference problems. We also disagree with Verizon Wireless that no incumbents would need to be relocated from the 2495-2500 MHz band. There are grandfathered stations in the BAS and private radio services that may need to be relocated eventually to accommodate BRS use of the band.¹⁸⁶ In this Order, however, we decline to set forth a specific relocation plan for the remaining grandfathered incumbents at 2495-2500 MHz, including BAS and private land mobile operators. We will provide a relocation plan, if necessary, when we address the remaining issues in ET Docket No. 00-258 concerning AWS relocation.

68. We also decline to reallocate a portion of S-band spectrum for other uses, including use by unlicensed devices and other licensed services such as critical infrastructure services. Because handling MDS/ITFS spectrum issues is a priority, we believe that we should address MDS/ITFS before we consider other uses, such as critical infrastructure services, in the S-band. Moreover, we note that we have already allocated or are considering allocating other spectrum to unlicensed services.¹⁸⁷ Therefore, we find no compelling reason to add unlicensed or critical infrastructure services to this band.

3. Fixed and Mobile Allocation at 2495-2500 MHz

69. We find that the public interest would be served by adding a new allocation at the 2495-2500 MHz band for fixed and mobile except aeronautical mobile services on a primary basis. The allocation will allow us to group together spectrum "neighbors" with technically compatible characteristics.¹⁸⁸ Specifically, in a separate proceeding, the Commission has undertaken a comprehensive evaluation of the 2500-2690 MHz band that is licensed to ITFS and MDS providers and is adjacent to the spectrum under consideration here.¹⁸⁹ Because we are considering proposals to restructure the 2500-2690 MHz band,

¹⁸⁵ See *supra* Section II.

¹⁸⁶ The grandfathered status of the incumbents in this band are set forth in conforming changes to Parts 2, 74, 90 and 101 of our rules, *infra* Appendix B.

¹⁸⁷ See, e.g., *Unlicensed Operation in the TV Broadcast Bands*, ET Docket No. 04-186, Notice of Proposed Rulemaking, FCC 04-113, 19 FCC Rcd 10018 (2004); *Unlicensed Operation in the Band 3650-3700 MHz*, ET Docket No. 04-151, Notice of Proposed Rulemaking, FCC 04-100, 19 FCC Rcd 7545 (2004); *Cognitive Radio Technologies NPRM*; *Interference Temperature NOI/NPRM*.

¹⁸⁸ As a result, this reallocation supports a guiding principle in the Spectrum Policy Task Force Report. See Spectrum Policy Task Force Report at 4.

¹⁸⁹ See *Amendment of Parts 1, 21, 73, 74 and 101 of the Commission's Rules to Facilitate the Provision of Fixed and Mobile Broadband Access, Educational and Other Advanced Services in the 2150-2162 and 2500-2690 MHz Bands*, WT Docket No. 03-66, Notice of Proposed Rulemaking and Memorandum Opinion and Order, FCC 03-56, 18 FCC Rcd 6722 (*MDS/ITFS NPRM*).

this is a particularly apt time to add a fixed and mobile except aeronautical mobile allocation to the 2495-2500 MHz band. Doing so allows us to integrate the spectrum at 2495-2500 MHz into a larger 2495-2690 MHz band plan and, as a result, establish a new BRS/EBS band plan and adopt service rules for both the 2495-2500 MHz and 2500-2690 MHz bands that would allow for the provision of similar services.¹⁹⁰

70. Integrating the fixed and mobile except aeronautical mobile allocation at 2495-2500 MHz band with the 2500-2690 MHz band could also provide opportunities to promote the development of new and innovative AWS. We note that, in the *First Report and Order* in ET Docket No. 00-258, the Commission added a mobile except aeronautical mobile allocation to the 2500-2690 MHz band to provide additional near-term and long-term flexibility, thereby making that band potentially available for advanced mobile and fixed wireless services.¹⁹¹ As part of the AWS inquiry in ET Docket No. 00-258, we recognized that the public demand for mobile services, as evidenced by terrestrial services' high subscribership growth, and the need for additional spectrum to continue development, supported the identification of new spectrum that could be made available for fixed and mobile services.¹⁹² In proposing a restructured 2500-2690 MHz band, the Commission stated that "we anticipate that the streamlined regulations and revised spectrum plan adopted in this proceeding will facilitate the provision of advanced wireless communications services by incumbent licensees."¹⁹³ We anticipate that we could offer similar opportunities for the 2495-2500 MHz band as part of a reallocation to fixed and mobile terrestrial services.

71. Furthermore, we agree with those commenters suggesting that some spectrum immediately below 2500 MHz, combined with the restructuring of MDS/ITFS spectrum in the 2500-2690 MHz band, would serve as suitable replacement spectrum for MDS providers that currently operate at 2150-2162 MHz.¹⁹⁴ In a companion order adopted today, we further discuss the benefits of restructuring the 2500-

¹⁹⁰ In a companion item adopted in WT Docket 03-66, we capitalize on these possibilities and take steps to integrate the 2495-2500 MHz and 2500-2690 MHz bands as part of a larger restructuring of the 2.5 MHz licensees. See generally *MDS/ITFS Order*.

¹⁹¹ See *Amendment of Part 2 of the Commission's Rules to Allocate Spectrum Below 3 GHz for Mobile and Fixed Services to Support the Introduction of New Advanced Wireless Services, including Third Generation Wireless Systems*, ET Docket No. 00-258, First Report and Order and Memorandum Opinion and Order, FCC 01-256, 16 FCC Red 17222, 17223, ¶ 2 (2001).

¹⁹² See VoiceStream Wireless Corporation Reply Comments, ET Docket No. 00-258, at 8-9 (filed Nov. 8, 2001) (calculating an average of 648,000 United States customers per megahertz on 190 megahertz of spectrum allocated to terrestrial wireless services versus less than 5,000 global customers per megahertz on the spectrum that is allocated to MSS).

¹⁹³ *MDS/ITFS NPRM*, 18 FCC Red at 6725, ¶ 2.

¹⁹⁴ See *supra* ¶ 62; cf. Letter from Luisa L. Lancetti, Vice President for Sprint, to Marlene H. Dortch, FCC (dated June 3, 2004) (supporting the reallocation of the 2494-2500 MHz band to MDS); Letter from Joel Brick, Technical Director for Sioux Valley Wireless, to Michael K. Powell, Chairman, FCC (dated May 30, 2004) (supporting the reallocation of 6-8 megahertz of S-band spectrum for MDS). This option has been discussed in this proceeding and in ET Docket No. 00-258, the Commission's AWS proceeding. In ET Docket No. 00-258, the Commission previously identified spectrum in the 2150-2162 MHz band (which is currently licensed as MDS channels 1 and 2) as spectrum that could be used for AWS. In the *Second Report and Order* in ET Docket No. 00-258, the Commission reallocated the 2150-2155 MHz band as part of a 90 megahertz allocation for AWS. See *Amendment of Part 2 of the Commission's Rules to Allocate Spectrum Below 3 GHz for Mobile and Fixed Services to Support the Introduction of New Advanced Wireless Services, Including Third Generation Wireless Systems*, ET Docket (continued....)